Peach Bottom Atomic Power Station
Units 2 and 3

License Amendment Request for
Measurement Uncertainty Recapture Uprate

NRC Pre-Submittal Meeting
April 26, 2016

Exelon Generation®

Introductions

Attendance

• Marv Lohmann – Sr Director Power Uprate	Exelon
• Dave Henry - Station Engineering Director	Exelon
• John Rommel – Director Engineering	Exelon
• Steve Minnick - MUR Sr Project Manager	Exelon
• Jim Armstrong – Station Regulatory Assurance Mgr.	Exelon
• Kevin Borton - Sr Manager	Exelon
• Andy Olson - Sr Staff Engineer, Fuels	Exelon
• Bill McDonald – Manager Engineering	Exelon
• David Neff – Principal Regulatory Engr.	Exelon
• George Paptzun – Manager Projects	GEH
• Larry King – Project Director	GEH
• Jim Harrison – Project Manager, Licensing	GEH
• Curt Robert – Manager, Transient Analysis	GEH
• John Hannah – Technical Leader, Methods	GEH

Agenda

- PBAPS Station
  - Power History Overview
  - Equipment Upgrades and Performance
- License Amendment Request Quality
- Technical Evaluations
- GEH TSAR Examples
- MUR Project Schedule

PBAPS Station
Power History / Upgrades and Performance

Dave Henry

Exelon Generation®

Station Overview

- General Electric BWR-4, Mark I Containment
- Containment design pressure 56 psig
- Began commercial operation in 1974, OLTP 3293 MWt
- Current Power Level 3951 MWt, EPU U2 and U3 2015
- 24 month operating cycle
- GNF2 full core
- Licensed for Increased Core Flow (ICF) (110%)
- Caldon CheckPlus® Leading Edge Flow Meter (LEFM) currently installed on Units 2 and 3

PBAPS Power History

Key Milestones	Year	MWth
➢ Full Power Operating License (Original Licensed Thermal Power - OLTP)	1973 (U2) 1974 (U3)	3293 3293
➢ Stretch Power Uprate (105% OLTP)	1994 (U2) 1995 (U3)	3458 3458
➢ MELLLA Operating Domain	1995	N/A
➢ MUR Uprate (1.62% increase)	2002 (U2) 2002 (U3)	3514 3514
➢ Renewed Operating License	2003	N/A
➢ Option III Stability Solution	2005	N/A
➢ GNF2 Fuel Introduction	2010	N/A
➢ Extended Power Uprate (120% OLTP)	2015 (U2) 2015 (U3)	3951 3951
➢ MELLLA+ Using DSS-CD	2016	N/A
➢ Proposed MUR	2018 (U2) 2018 (U3)	4016 4016

PBAPS Upgrades and Performance

- Replaced Steam Dryers
- Added Main Steam Safety Valves
- Eliminated Containment Accident Pressure Credit
- Increased Standby Liquid Control B-10 Enrichment
- Condensate Storage Tank Modifications
- Added Condensate Filter Demineralizers
- Replaced Condensate Pumps and Motors
- Upgraded Reactor Feedpump Turbines
- Replaced Feedwater Heaters
- Reactor Water Clean Up System Improvements
- Generator and Turbine Retrofit
- Auto Voltage Regulator Improvements
- MPT Upgrades
- MELLLA+ Provides Greater Operations Flexibility and Control

Plant upgrades provide margin to operate at TPO power levels

License Amendment Request

Kevin Borton

Exelon Generation®

License Amendment Request (LAR) Quality

- NRC SE for Thermal Power Optimization (TPO) Licensing Topical Report NEDC-32938P-A

SE Section 3.0 - Licensing Approach:

"….In section 4.2.1 and Appendix B to the TPO LTR, GENE proposes categorizing the evaluations supporting a TPO as follows:

1. Bounded by the CLTP Analysis and Evaluations
2. Generically Dispositioned
3. Plant-specific Evaluation

SE Section 4.2 - Applicability of the TPO LTR to Extended Power Uprate:

"….plants seeking to apply a TPO uprate to a previous uprate that would result in licensed thermal power (LTP) in excess of 120 percent of the original licensed thermal power (OLTP) must provide plant-specific evaluation for those evaluations not performed at 102 percent current licensed thermal power."

"The staff finds the approach acceptable since for EPU plants the TSAR will either confirm that the analyses and evaluations performed at the CLTP bound the TPO operating condition, or provide plant-specific justification and evaluation or analysis."

LAR Continued.....

- Therefore, the methods used for evaluating the PBAPS MUR are:
  - Existing PBAPS evaluations that are bounded by the current CLTP evaluations (performed at ≥ 102% CLTP)
  - Plant -specific evaluations
- Generically dispositioned evaluations will not apply
- PBAPS plant-specific evaluations will include the GEH TPO LTR evaluation methods (TSAR examples)
- EPU and MELLLA+ will be included in the existing and plant-specific licensing bases evaluations

LAR Continued.....

- License Application Request
  - Cross-reference to guidance in RIS 2002-03, “Guidance on the Content of MUR Power Uprate Applications”
  - GEH Safety Evaluation (TSAR) incorporates previous Industry responses to applicable RAIs for MURs
  - Use of approved guidance where applicable
    - GEH licensing topical report TPO LTR
    - Caldon LEFM topical reports and NRC safety evaluation criteria

- LAR will meet the scope and depth of NRC LIC-109, “Acceptance Review Procedures”

Familiar and Complete BWR License Application Format

Technical Evaluations

John Rommel

Exelon Generation®

Technical Evaluations

- Using existing EPU and MELLLA+ methods
- Existing Caldon CheckPlus® LEFM equipment
- Technical Evaluations
  - ECCS NPSH for Appendix R
  - ATWS and ATWSI (MELLLA+)
  - Replacement Steam Dryer
  - Turbine Control Valve Position
- Do not Anticipate Plant Equipment Modifications
- Meets eligibility criteria 10 CFR 51.22 (c)(9) for environmental categorical exclusion

GEH TSAR Examples

TSAR Examples

- Although same approach and methods, the TSAR sections will include additional content changes that will support the NRC Review
  - EPU licensing basis
  - MELLLA+ licensing basis
  - No generic dispositions

Example of TSAR Existing Evaluation

4.1 CONTAINMENT SYSTEM PERFORMANCE

TLTR Appendix G presents the methods, approach, and scope for the TPO uprate containment evaluation for LOCA. The ~~current~~ existing plant-specific containment evaluations were performed at 102% of CLTP. Although the nominal operating conditions change slightly because of the TPO uprate, the required initial conditions for containment analysis inputs remain the same as previously documented in the current licensing basis which includes EPU and MELLLA+.

The following table summarizes the effect of the TPO uprate on the various aspects of the containment system performance, and was verified against the current evaluation performed at 102% CLTP.

Topic	Key Parameters	TPO Effect
Short term Pressure and Temperature Response		Current Analysis Based on 102% of CLTP
Gas Temperature	Break Flow and Energy	
Pressure	Break Flow and Energy	
Long-Term Suppression Pool Temperature response		
Bulk Pool	Decay Heat	
Local Temperature with SRV Discharge	Decay Heat	
Containment Dynamic Loads		
Loss-of-Coolant Accidents Loads	Break Flow and Energy	
Safety-Relief-Valve Loads	Decay Heat	
Sub compartment Pressurization	Break Flow and Energy	
Containment Isolation Section 4.1.1 provides confirmation that MOVs are capable of performing Design Basis functions at TPO Conditions.		Ability of containment isolation valves And operators to perform their required Functions is not affected because the evaluations have been performed at 102% of CLTP

Example of TSAR Plant-Specific Evaluation

3.9 REACTOR CORE ISOLATION COOLING

The reactor core isolation cooling (RCIC) system provides inventory makeup to the reactor vessel when the vessel is isolated from the normal high pressure makeup systems. A plant-specific evaluation was performed for PBAPS using the evaluation approach ~~The generic evaluations~~ presented in the TLTR Section 5.6.7. ~~are consistent for application to the PBAPS TPO uprate considering~~

The plant-specific evaluation was performed using the current licensing basis which includes EPU and MELLLA+, and specifically verified that there is no change in the following: operating pressure or the pressure set-points of the SRVs, the capability of the turbine-driven system to successfully develop the horsepower and speed required by the pumps is unchanged. The plant-specific evaluation also concludes that the LOFW analysis-of-record for the plant-specific applications bounds the TPO uprate operating condition, the RCIC capacity and the decay heat calculations are unchanged (based on 102 percent CLTP), and the capability to maintain the water level above the TAF will remain unchanged. ~~the current licensing basis.~~ The TPO uprate does not affect the RCIC system operation, initiation, or capability requirements.

Example of TSAR Additional Basis Evaluation

9.3.1 Anticipated Transient Without Scram

A plant-specific evaluation was performed using the approach in the current licensing basis. ~~, present a generic evaluation of the sensitivity of an ATWS to a change in power typical of the TPO uprate. The evaluation is based on previous analyses for power uprate projects. For a TPO uprate, if a plant has sufficient margin for the projected changes in peak parameters given in TLTR Section L.3.5, …~~…

Accordingly, a plant-specific analysis of the limiting ATWS events, consistent with the MELLLA+ Safety Analysis Report **(Reference YY**), was performed at the TPO power level. The assumptions and approaches in this analysis are consistent with those stated in **Reference YY.**

Additional details as applicable from the TSAR ATWS text…..

The ATWS results at the TPO power level, including the MELLLA+ results in **Table 9-X ,** show that all criteria are met.

Similarly, an analysis was performed for the limiting ATWS with Instability (ATWSI) event, from the TPO power level on the MELLLA+ licensed upper boundary (rod line). Because the ATWSI response is largely based on the rod line, there is very little impact to the slight increase in the initial power level. The key ATWSI results shown in **Table 9-Z** show essentially the same results and confirm an acceptable clad temperature response.

Example of TSAR Plant-specific Evaluation

6.5 STANDBY LIQUID CONTROL SYSTEM

The SLCS is designed to shut down the reactor from rated power conditions to cold shutdown in the postulated situation that all or some of the control rods cannot be inserted. This manually operated system pumps a highly enriched sodium pentaborate solution into the vessel to achieve a sub critical condition. A plant-specific evaluation was performed for PBAPS using the evaluation approach presented in the TLTR Section 5.6.5. ~~The generic evaluation presented in TLTR Section 5.6.5 (SLCS) and Appendix L.3 (ATWS Evaluation) is applicable to the PBAPS TPO uprate.~~

The maximum reactor lower plenum pressure following the limiting ATWS event reaches **X,XXX psig** during the time the SLCS is analyzed to be in operation. The TPO evaluation shows the pressure margin for the SLCS pump discharge relief valves is **XXX psig** , which is above the minimum value needed to ensure that the SLCS relief valves remain closed during system injection. The minimum reactor pressure, just prior to the time when SLCS initiates, remains low enough to ensure SLCS relief valve closure prior to the analyzed SLCS initiation time in the event of an early initiation of the SLCS during the initial ATWS transient pressure response. Therefore, SLCS operation during an ATWS at the TPO power level is acceptable considering the MELLLA+ operating domain expansion.

The PBAPS TPO ATWS analysis is presented in Section 9.3.1. The ATWS evaluation shows that the TPO has no adverse effect on the ability of the SLCS to mitigate an ATWS. The TPO uprate does not affect shutdown or injection capability of the SLCS. Because the shutdown margin is reload dependent, the shutdown margin and the required reactor boron concentration are confirmed for each reload core.

Example of TSAR Section 3.6

3.6 REACTOR RECIRCULATION SYSTEM

A plant-specific evaluation was performed for the PBAPS ~~The~~ reactor recirculation system (RRS)~~, evaluation process is described~~ using the evaluation approach presented in TLTR Section 5.6.2. considering the current licensing basis, which includes EPU/MELLLA+. The TPO uprate has a minor effect on the RRS and its components. Operation at the TPO uprated power is accomplished along an extension of the current MELLLA+ rod line with no increase in the maximum core flow. ~~The TPO uprate does not require an increase in the maximum core flow.~~ No significant reduction of the maximum flow capability occurs due to the TPO uprate because of the small increase in core pressure drop (< 1 psi). The effect on pump net positive suction head (NPSH) at TPO conditions is negligible. An evaluation has confirmed that no significant increase in RRS vibration occurs due to TPO operating conditions.

The cavitation protection interlock for the recirculation pumps and jet pumps is expressed in terms of FW flow. This interlock is based on sub-cooling and thus is a function of absolute FW flow rate and FW temperature at less than full thermal power operating conditions. Therefore, the interlock is not changed by TPO.

PBAPS MUR Project Schedule

Steve Minnick

Exelon Generation®

Schedule

- Analysis / LAR development - June 2016 thru Aug 2017
- Submit License Application - Sept 2017
- Post Submittal meeting w/Key NRC reviewers - Oct 2017
- Request NRC approval - Sept 2018
- Unit 2 and Unit 3 Implementation - Sept thru Nov 2018

Both Units will be Ready for Power Ascension
Upon LAR approval